



SOARD Overview

*Southern Office of
Aerospace Research and
Development*

06 MAR 2012

James Fillerup, PE, Director

**Southern Office of Aerospace
Research and Development**

Air Force Office of Scientific Research

Integrity ★ Service ★ Excellence

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2012 AFOSR SPRING REVIEW PORTFOLIO OVERVIEW



NAME: James Fillerup, Director, AFOSR/SOARD

BRIEF DESCRIPTION OF PORTFOLIO:

Explore and engage Latin America research in collaboration with AFRL Program Managers in accordance with AFOSR BAA 2011-1.

LIST SUB-AREAS IN PORTFOLIO:

**Manage AFOSR Basic Research Programs and Initiatives in L.A.
Support AFRL TD Research Thrusts
Respond to OSD and SAF/IA Bi-Lateral Forums
Support U.S. Embassy-Santiago Mission**



SOARD Region



Most Proximate Countries

- **Argentina:** 22nd GDP(PPP)
 - Population: 40 M
 - Buenos Aires: 13M
- **Brazil:** 8th GDP (PPP)
 - Population: 192 M
 - Sao Paulo: 20 M
- **Chile:** (high GDP/capita)
 - Population: 18M
 - Santiago: 5 M
- **Mexico:** (11th GDP (PPP))
 - Population: 113 M
 - Mexico City: 21



A Sample of Latin America Resources & Science



#1 Sugarcane Producer

Sugarcane production dependent on GPS systems for planting and harvest, local region space weather impacts industry creating a niche science area relevant to AF needs*



Figure 4 - Location of the GPS receivers. SCAMATA (●) and Alouette (▲).



Iron ore

Industry making science investments: Example \$0.4B USD infrastructure investment by Vale Technology Institute*



Oil

Local government and industry making investment into Brazilian science: Example \$0.7B USD PETROBRAS R&D Center, \$1.5B USD Global Tech Center Federal Univ of Rio de Janeiro*





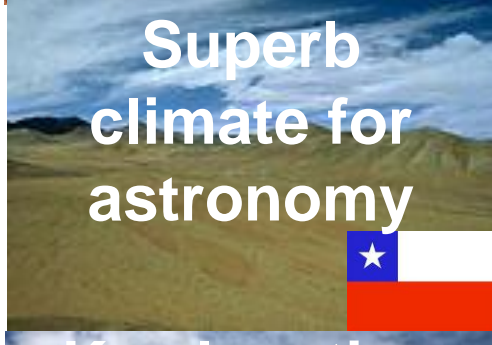
A Sample of Latin America Resources & Science



Copper 20%
world
supply



Superb
climate for
astronomy



Key location
for X- radio
observatory



CONICYT \$0.45B USD, Int. Copper Assoc \$0.1B USD, COLDELCO – Billions in infrastructure investment, ex. \$6M USD bioleaching, ... copper fiber to kill bacteria, robotics, aquaculture*



High, dry, quite, clear location makes Chile key astronomy center in the world, for example Atacama, Atacama Large Millimeter/Sub-Millimeter Array (ALMA) \$1B USD*



World-class science is found across S. America, example: Jicamarca Radio Observatory is the premier location for equatorial ionosphere study*





South American Capabilities (DoD perspective)



- **Presentation: “South American Partner Nations’ Technology Capabilities”** *by ASD(RE), May 2011*

Hon. Zachary Lemnios

- **Brazil:**

- Energy (Nuclear / Biofuels), Life Sciences, Aerospace, Weapons, Materials, Nanosciences, Information Technologies, Maritime Situational Awareness

- **Colombia:**

- Materials (Armor), Shipbuilding (Riverine crafts), IEDs

- **Chile:**

- M&S, Information Technology, Shipbuilding (OPVs / Oceanographic vessels)

- **Argentina:**

- Aerospace (Micro-Satellites), Cyber, Unmanned Systems

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AFOSR Technology Investment



AERODYNAMICS

- Aerothermodynamics , J.Schmisser
- Flow Interactions and Control, Dr. Douglas Smith

COMPUTER SCIENCE

- Systems/software/complex network, R.Bonneau

ENERGY

- Space Power and Propulsion, M. Birkan

MATERIALS SCIENCE

- Configurable Multifunctional Structures, L.Lee
- Organic Materials Chemistry, C.Lee
- Materials for Extreme Environments,A.Sayir
- Structural Mechanics and Prognosis, D Stargel

MATHEMATICS

- Computational Mathematics, F.Fahroo
- Optimization & Discrete Mathematics, D.Hearn

NATURAL MATERIALS/BIOMIMETRICS

- Natural Materials and systems, H.Delong

SPACE SCIENCES

- Space Science, C.Fesen
- Remote Sensing &Imaging / SSA, K.Miller

PHYSICS

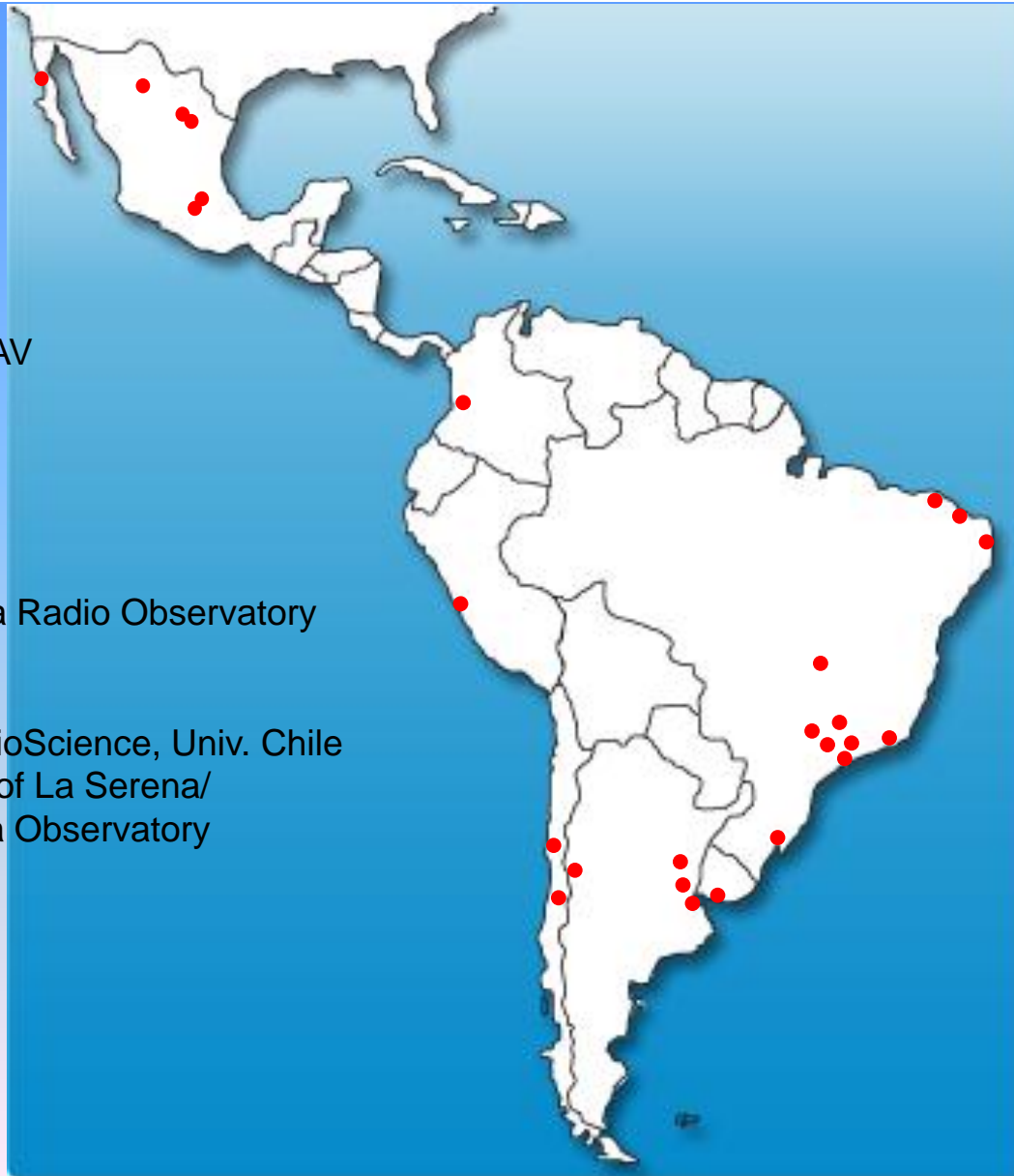
- Quantum Electronics, H.Weinstock
- Plasma and Energetic Physics, J.Luginsland, T.Hussey
- Electromagnetics, A.Nachman
- Atomic and Molecular Physics , T.Curcio





AFRL/AFOSR Research Partners

(31 Institutions/ 42 Research Grants- 2011)



Mexico

- Ensenada: CICESE
- Chihuahua: CIMAV
- Saltillo: CITA
- Monterrey: CMAV
- Queretaro: CINVESTAV

Colombia

- Cali: CITA

Peru

- Lima: Alcon/Jiramarca Radio Observatory

Chile

- Santiago: USACH, BioScience, Univ. Chile
- La Serena: University of La Serena/
Mamalluca Observatory

Uruguay

- Montevideo: ORT

Brazil

- Belo Horizonte: UFMG
- Brasilia: EMBRAPA
- Fortaleza: UFC-Pici
- Joao Pessoa: UFPaiba
- Recife: UFPE
- Rio de Janeiro: UFRJ,
PUC-Rio, CEPEL
- Itajuba: UNIFEI
- Campinas: UNICAMP,
CTA EVa
- Sao Carlos: USP-SC
- Sao Jose dos Campos:
INPE, CTA IEAv
- Sao Paulo: MacKenzie
- Porto Alegre: UFRGS

Argentina

- Buenos Aires:
UNSAM, KHU
- Santa Fe: IMAL
- Rosario: Austral
- San Juan: CASLEO



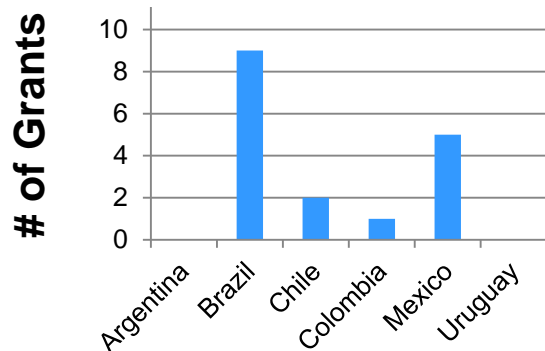
SOARD

FY11 Activity Summary

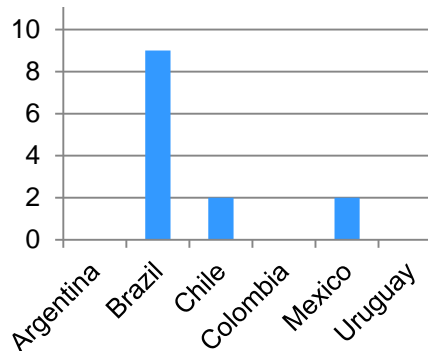


COUNTRY	WOS	CSP	R & D new starts/total
 Argentina	0	1	0 / 4
 Brazil	3	2	9 / 23
 Chile	3	1	2 / 4
 Colombia	0	0	0 / 1
 Mexico	1	2	2 / 9
 Uruguay	1	0	0 / 1
TOTAL	8	6	13 / 42

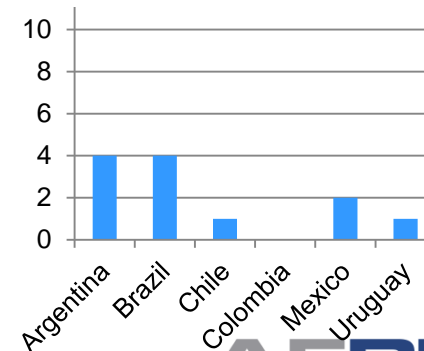
**Aerospace, Chemical
and Material Science**



**Physics and
Electronics**



**Mathematics, Information,
and Life Sciences**





Brazil / Argentina Space Science



Research Partners:

Mackenzie Univ, SP, Brazil

CASLEO Observatory, San Juan, Arg.

All equipment owned by Brazil and operated by CASLEO, Argentina.

Funding: FAPESP, CNPq, CONICET, AFOSR

Project: The Search For New Approach To Detect Solar CME Precursors At Sub-THz And Mid-IR Frequencies

Recent Activity:

- Installation of 45GHz and 90 GHz radio telescopes at CASLEO, Argentina (Nov 2011)



Solar Observatory



45 and 90 GHz Radiometer



Brazil / Peru Ionosphere



Research Partners:

Nat'l Institute for Space Research
(INPE), Brazil

Catholic Univ of Rio de Janeiro (PUC-
Rio), Brazil.

Jicamarca Radio Observatory, Peru

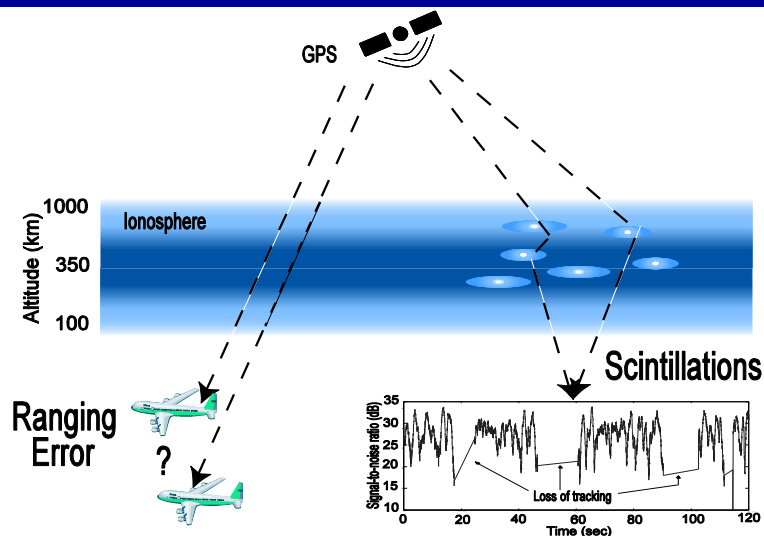
Project: Ionospheric Irregularities

Predictions and Plumes

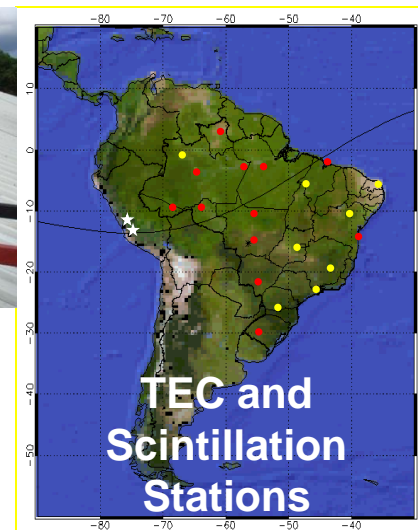
Characterization for Satellite Data
Validation and Calibration

Recent Activity: Provide data for space- based scintillation models (AFRL SCINDA, PUC-Rio algorithm)

Christmas Island, São Luís, and Jicamarca
Stations primary source of AFRL data.



**TBB and GPS
antennas at São
Luis - AFRL/INPE
campaign, 2008**





Brazil Hypersonics



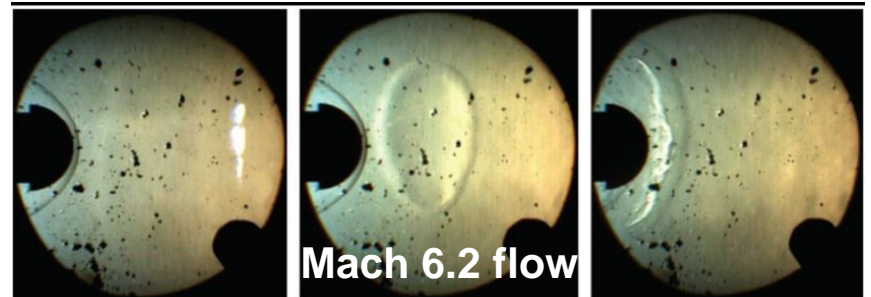
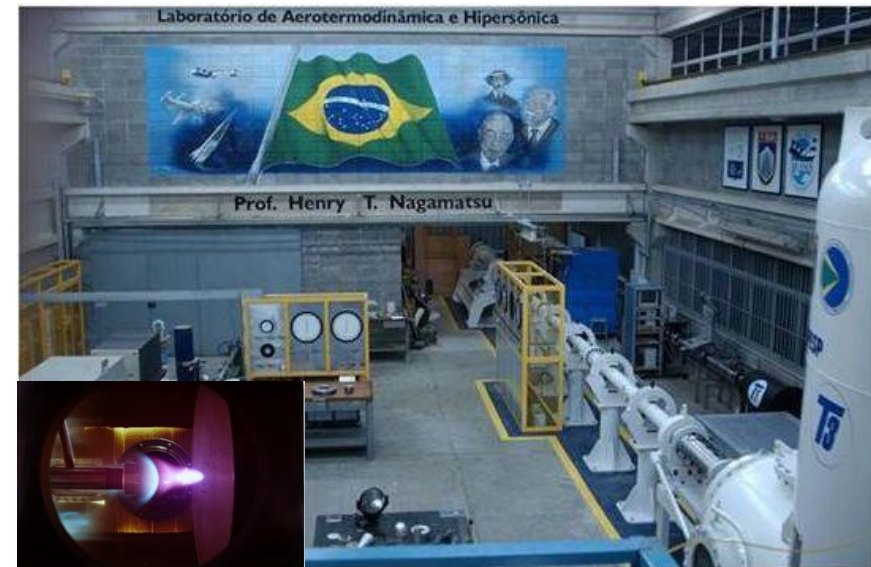
Research Partner: Institute for Advanced Science Studies,
General-Command for Aerospace Technology (IEAv CTA),
Sao Jose dos Campos

Project:

Laser-Induced Air Breakdown
in Low-Density for Hypersonic
Flow Control

Accomplishments

- Demonstrated directed energy air spike (DEAS) concept in Mach 6.2 and Mach 7.8 flows





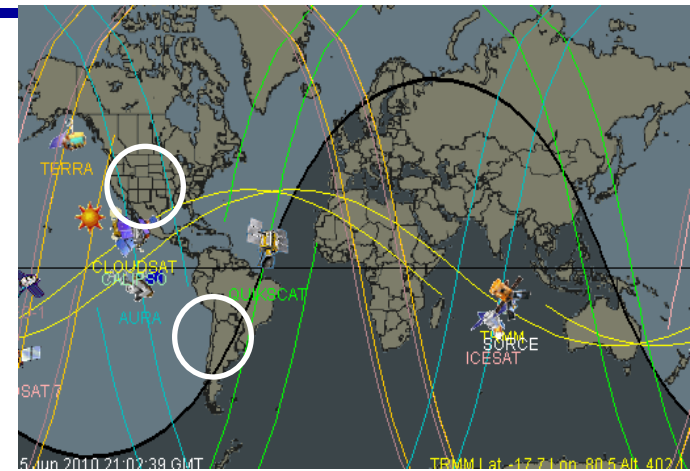
Chile

Space Situational Awareness



USAFA Falcon Telescope Network (FTN) For SSA

- Remote telescope network with one located in Chile to provide access to southern hemisphere



**51 cm dia.
Telescope for
Placement in Chile**

Collaborators

- AFRL/AFOSR
- USAF Academy
- Mamalluca Observatory
- Universidad of La Serena



**Mamalluca Observatory
near Vicuña, Chile**



Mexico

Photorefractive Materials

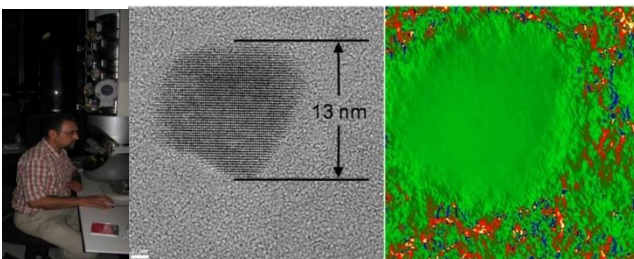


Research Partner: Research Center for Applied Chemistry (CIQA), Saltillo, Mexico

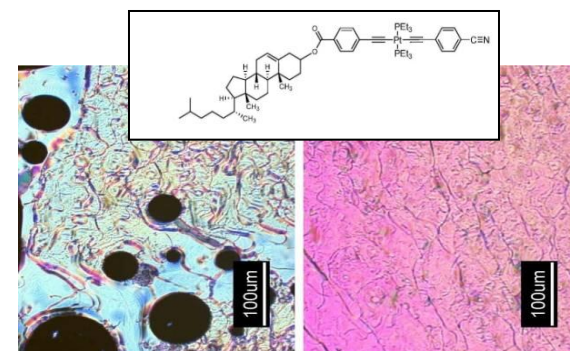
Strong relationship has developed with AFOSR and RX since US/Mexican Workshop in 2008

- **Project:** Synthesis of Chromophores for Nonlinear Optics
- **Project:** Rotaxane Molecular Switches
- **Project:** Liquid Crystals of Dendron-like Pt Complexes –Nanofilms

HRTEM image Strain Map



Ferro-electricity discovered in nanoparticle as small as 9 nm.



Synthesized compound showing liquid crystallinity.



US/Mexico Basic Research Initiative



Highlights

- **Mid-term review: February 8-9, 2012 at Tech^Edge in Dayton, OH**

US/Mexican Basic Research Initiative Projects

- **“Modeling, Development and Characterization of Alternate Electrodes for Flexible Electronics Applications”**
 - Centro de Investigación en Materiales Avanzados (**CIMAV**)
 - University of Texas- Dallas, (**UT-Dallas**)
- **“Multiphase Multifunctional Ceramic Coatings”**
 - Centro de investigación y de Estudios Avanzados del Instituto Politecnico Nacional Unidad Queretaro (**CINVESTAV- Qro**)
 - University of California Santa Barbara (**UCSB**)
- **“Hybrid Solid-State Photovoltaic Materials and Devices”**
 - Centro de Investigación de Química Aplicada (**CIQA**)
 - University of Akron (**UA**)
- **“Laser-induced patterning of transparent ceramics and metallic thin films for photonic and sensing applications”**
 - Centro de Investigacion Cientifica y de Educacion Superior de Ensenada (**CICESE**)
 - University of California at Riverside (**UCR**)



-AFOSR funding US Universities
-CONACyT funding Mexican Academic Institutions



Future



- **Continue to advance S&T discovery in collaboration with AFRL PMs and Latin American partners.**
 - Primary focus on Argentina, Brazil, Chile, and Mexico.
 - Forge stronger bonds particularly with Brazil as it continues to surge forward in S&T (considering a Brazilian Initiative)
 - Seek opportunities to co-fund research to leverage research dollars



23 AF Participating PMs Supporting SOARD